|  |  |  |  |
| --- | --- | --- | --- |
| **In This Topic**  **Unit 2 (Biochemistry) – Drawing Connections between Topics and Concepts- SIMPLIFIED AND WITHOUT IMAGES**  Ms. Ottolini, AP Biology | **We learned …** | **Which Relates to…** | **From this Topic…** |
| Atomic and Molecular Structure | A polar covalent bond (ex: between oxygen and hydrogen) results in one atom having a slight negative charge (ex: oxygen) and one atom having a slight positive charge (ex: hydrogen). | Water is a polar molecule and can act as a solvent for other charged and polar molecules 🡪 sugars and waste products dissolve in blood (which is mostly water) | Properties of Water |
| Water’s polarity allows it to form hydrogen bonds. Hydrogen bonding enables cohesion and adhesion which enable capillary action. Without capillary action, plants would not be able to transport water from their roots to their leaves. |
| Water’s polarity allows it to form hydrogen bonds. Hydrogen bonding enables water’s high specific heat. Since organisms are mostly made of water, they do not change temperature as much as their surroundings and are able to keep a constant body temperature so that their enzymes will function optimally. |
| Atomic and Molecular Structure | Based on the types of bonds between atoms (i.e. polar or nonpolar covalent) functional groups will demonstrate certain chemical properties. | The chemical properties of functional groups found in macromolecules determine their function. | Macromolecules |
| Example #1: Hydroxyl groups on sugar molecules make them able to dissolve in water. This enables sugars to travel easily through the bloodstream (which is mostly water). |
| Example #2: Methyl groups and C-H within phospholipid tails make them nonpolar/hydrophobic. Phosphate groups within phospholipid heads make them polar / hydrophilic. Due to their nonpolar and polar regions, phospholipids arrange themselves in a double layer which prevents large / polar / charged particles from entering the cell (ex: viruses). |
| Environmental Matter Exchange | Organisms take in atoms of particular elements to use within the molecules that make up their tissues (i.e. the macromolecules). | Carbon and oxygen are used in carbohydrates, lipids, proteins, and nucleic acids. They are taken into organisms’ bodies through photosynthesis (when plants convert CO2 to glucose using the energy in sunlight) and when other organisms eat plants. | Macromolecules |
| Hydrogen and oxygen are used in carbohydrates, lipids, proteins, and nucleic acids. They are taken into plants’ tissues by absorption via the roots. They are taken into animals’ tissues when animals drink water or eat plants and absorb the water in the plant tissues. |
| Nitrogen is used in proteins (in amino groups of amino acids) and nucleic acids (in nitrogen bases of nucleotides). It is taken into plants’ tissues by absorption of nitrate (NO3-) via the roots (after soil bacteria convert nitrogen gas from the air into a form usable by plants via nitrogen fixation and then nitrification). It is taken into animals’ tissues when animals eat plants and break down their proteins and nucleic acids to create their own proteins and nucleic acids. |
| Phosphorus is used in nucleic acids (in phosphate groups of nucleotides). Sulfur is used in proteins (in SOME “R groups” of amino acids containing sulfhydryl functional groups). Both of these elements are taken into plants’ tissues by absorption of soil phosphorus and sulfur via the roots. It is taken into animals’ tissues when animals eat plants and break down their proteins and nucleic acids to create their own proteins and nucleic acids. |
| Atomic and Molecular Structure | The atoms and functional groups within an active site and on the surface of the substrate will enable the substrate to bind to the active site. | For example a positively charged amino group [NH3+] that has received an extra H+ within the active site will be attracted to a negatively charged carboxyl group [COO-] that has given up an H+ within a substrate. Since the substrate is able to bind to the active site, the enzyme can help catalyze the reaction (either joining several substrates together or breaking one substrate into several products). | Enzymes |
| Enzymes | Enzymes facilitate and improve the efficiency of MANY reactions involving macromolecules within the cell | An example of a reaction involving macromolecules that is facilitated by an enzyme is the breakdown of a disaccharide (sucrose) into two monosaccharides (glucose and fructose) through the process of hydrolysis and the use of the enzyme sucrase | Macromolecules |